CLAIMS

What is claimed is:

1. A recombinant polynucleotide comprising a plurality of first polynucleotides encoding an identical antigenic peptide and wherein the first polynucleotides are operatively linked to each other to enhance translation of the polynucleotides to the antigenic peptide and binding of the antigenic peptide to MHC molecules.

2. The recombinant polynucleotide of claim 1, further composing a plurality of a second polynucleotide encoding multiple copies of an antigenic peptide having an amino acid sequence that is different from the peptides encoded by the first polynucleotides.

3. The recombinant polynucleotide of claim 1, wherein the plurality of first polynucleotides is 2 or more.

4. The recombinant polynucleotide of claim 1, wherein the plurality of first polynucleotides is 7 or more.

5. The recombinant polynucleotide of claim 1, wherein the plurality of first polynucleotides is 9 or more.

6. The recombinant polynucleotide of claim 1, wherein the plurality of first polynucleotides is 13 or more.

7. The recombinant polynucleotide of claim 2, wherein the plurality of second polynucleotides is 2 or more.

8. The recombinant polynucleotide of claim 2, wherein the plurality of second polynucleotides is 7 or more.

9. The recombinant polynucleotide of claim 2, wherein the plurality of second polynucleotides is 9 or more.

10. The recombinant polynucleotide of claim 2, wherein the plurality of second polynucleotides is 13 or more.

11. The recombinant polynucleotide of claims 1-10, further comprising a promoter operatively linked to the polynucleotide.

12. The recombinant polynucleotide of claims 1-10, further comprising a polynucleotide encoding a cytokine.

13. The recombinant polynucleotide of claims1-10, further comprising a polynucleotide encoding a costimulatory molecule.

14. The recombinant polynucleotide of claims 1-10, further comprising a polynucleotide encoding a cytokine and a polynucleotide encoding a costimulatory molecule.

15. The recombinant polynucleotide of claims 1-10, further comprising a polynucleotide encoding a plurality of amino acids inserted between the plurality of polynucleotides encoding the antigenic peptides.

16. The recombinant polynucleotide of claim 15, wherein the plurality of amino acids is at least three alanines.

17. The recombinant polynucleotide of claims 1-10, further comprising a polynucleotide having mRNA stability activity operatively linked to the polynucleotides encoding the antigenic peptides to stabilize the mRNA transcribed

from the recombinant polynucleotide.

18. The polynucleotide of claim 12, wherein the polynucleotide having mRNA stability activity is the 3' UTR of the α-globulin gene.

19. The recombinant polynucleotide of claims 1-10, wherein the antigenic peptide is an antigenic fragment of a tumor associated antigen.

20. The recombinant polynucleotide of claim 19, wherein the tumor associated antigen is selected from the group consisting of melanoma gp 100, MART-1, melan-A, tyrosinase, TRP-1, TRP-2, Her-2, Muc-1, and CEA.

21. The recombinant polynucleotide of claim 19, wherein the tumor associated antigen is gp 100.

22. The recombinant polynucleotide of claim 19, wherein the antigenic fragment of a tumor associated antigen is gp 209 of gp 100.

23. The recombinant polynucleotide of claims 1-10, wherein the antigenic peptide is a fragment of pathogenic antigen.

24. The recombinant polynucleotide of claims 23, wherein the pathogen is a bacteria or virus.

25. A gene delivery vehicle comprising the recombinant polynucleotide of claims 1-10.

26. The gene delivery vehicle of claim 25, wherein the vehicle is selected from the group consisting of a viral vector, a liposome, and a plasmid.

27. A gene delivery vehicle comprising the recombinant polynucleotide of claim 11.

28. The gene delivery vehicle of claim 27, wherein the vehicle is selected from the group consisting of a viral vector, a liposome, and a plasmid.

29. A host cell comprising the recombinant polynucleotide of claims 1-10.

30. The host cell of claim 29, wherein the host cell is a eucaryotic or a procaryotic cell.

31. The host cell of claim 29, wherein the cell is a dendritic cell.

32. The host cell of claim 29 or 31, wherein the cell is a mammalian cell.

33. The host cell of claim 32, wherein the mammalian cell is a human cell.

34. The host cell of claim 31, wherein the dendritic cell is an antigen presenting cell.

35. A method for presenting antigenic epitopes on the surface of an antigen presenting cell comprising introducing the recombinant polynucleotide of any of claims 1-10 under suitable conditions such that the polynucleotide encoding the antigenic peptide is translated and presented on the surface of the antigen presenting cell.

36. A method for generating educated, immune effector cells comprising culturing the host cells of claim 34 with naïve immune effector cells under conditions such that the immune effector cells proliferate at the expense of the host cells.

37. An educated immune effector cell, which has been, cultured in the presence and at the expense of the cells of claim 34.

38. A method of modulating an immune response in a subject, comprising administering to the subject an effective amount of the polynucleotide of claims 1-10.

39. A method of modulating an immune response in a subject, comprising administering to the subject an effective amount of the host cell of claim 34.

40. A method of modulating an immune response in a subject, comprising administering to the subject an effective amount of the immune effector cell of claim 37.

41. The method of claim 38, further comprising administering an effective amount of a cytokine and/or costimulatory molecule to the subject.

42. The method of claim 39, further comprising administering an effective amount of a cytokine and/or costimulatory molecule to the subject.

43. The method of claim 40, further comprising administering an effective amount of a cytokine and/or costimulatory molecule to the subject.